

QUIZ NAVIGATION



Rose Wang



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Started on	Tuesday, 15 October 2024, 2:55 AM
State	Finished
Completed on	Tuesday, 15 October 2024, 3:00 AM
Time taken	4 mins 53 secs
Marks	8.0/9.0
Grade	88.9 out of 100.0

Question 1

ID: 54391

Correct

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Erythropoiesis-stimulating agents (ESA) are sometimes used to treat anemia. What is the most likely reason for inadequate response to ESA therapy in patients with chronic kidney disease?

Select one:

- ☐ The patient is allergic to erythropoiesis-stimulating agents (ESA) ✖
- ☒ The patient's serum iron level is depleted ✔
- ☐ The patient's dose of erythropoiesis-stimulating agent (ESA) is too low ✖
- ☐ Low erythropoietin is not the cause of anemia in chronic kidney disease ✖

Rose Wang (ID: 113212) this answer is correct. Lack of iron stores will not allow red blood cell formation, even if there is sufficient erythropoietin in the blood.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease**LEARNING OBJECTIVE:**

To understand the role of erythropoiesis-stimulating agents (ESA) in patients with anemia secondary to chronic kidney disease.

BACKGROUND:

The kidneys filter about half a cup of blood per minute and are responsible for the following:

- *Optimizing acid-base balance*
 - The kidneys secrete hydrogen into the forming urine in order to raise blood pH
- *Regulating electrolyte levels*
 - The kidney's absorption and secretion of sodium is affected by the renin-angiotensin-aldosterone system (RAAS) and antidiuretic hormone (ADH)
 - Potassium moves in the opposite direction of sodium (e.g., potassium is excreted into the urine if sodium is reabsorbed)
 - Chloride is regulated along with sodium via sodium-chloride symporter (i.e., co-transporter) channels in the kidneys
- *Regulating calcium and phosphate levels*
 - If serum calcium levels are low, parathyroid hormone (PTH) is released and stimulates the kidney to reabsorb calcium into the blood and excrete phosphate into the urine
 - If serum calcium levels are normal or high, PTH level is reduced, resulting in calcium excretion into urine and reabsorption of phosphate
- *Vitamin D activation*
 - PTH stimulates renal conversion of 25-hydroxycholecalciferol (i.e., calcidiol) into 1,25-hydroxycholecalciferol (i.e., calcitriol)
 - Calcitriol is the active form of vitamin D, which increases gut uptake of calcium
- *Optimizing red blood cell production*
 - The kidneys release erythropoietin (EPO) in response to low oxygen levels in the filtered blood
 - EPO stimulates the bone marrow to produce more red blood cells
 - If anemia occurs due to reduced EPO, erythropoietin-stimulating agents (ESA) can be administered but the patient needs to have sufficient iron levels as iron is mandatory for the production of red blood cells
- *Regulating blood pressure*
 - Cells surrounding the kidney's afferent arteriole release renin in response to low blood pressure
 - Renin is converted to angiotensin I, which in turn is converted into angiotensin II
 - Angiotensin II is responsible for the immediate systemic vasoconstriction, as well as a sustained release of aldosterone

release of aldosterone

- Aldosterone causes sodium reabsorption in the kidney, resulting in fluid retention and blood pressure increase
- Getting rid of waste such as drug metabolites

RATIONALE:

Correct Answer:

- **The patient's serum iron level is depleted** - Lack of iron stores will not allow red blood cell formation, even if there is sufficient erythropoietin in the blood.

Incorrect Answers:

- **The patient is allergic to erythropoiesis-stimulating agents (ESA)** - It is rare to have an allergy to erythropoiesis-stimulating agents (ESA).
- **The patient's dose of erythropoiesis-stimulating agent (ESA) is too low** - As erythropoiesis-stimulating agents (ESA) are dosed based on patient weight, it is likely that initial dosing is accurate.
- **Low erythropoietin is not the cause of anemia in chronic kidney disease** - Anemia in chronic kidney disease can be caused by iron store depletion and/or lack of erythropoietin production by the kidneys.

TAKEAWAY/KEY POINTS:

If chronic kidney disease-induced anemia occurs due to reduced erythropoietin (EPO), erythropoiesis-stimulating agents (ESA) can be administered but the patient needs to have sufficient iron levels as iron is mandatory for the production of red blood cells.

REFERENCE:

[1] OpenStax. *Anatomy & Physiology*. OpenStax CNX. 2016. <http://cnx.org/contents/14fb4ad7-39a1-4eee-ab6e-3ef2482e3e22@8.24>.

The correct answer is: The patient's serum iron level is depleted

Question 2

ID: 34393

Correct

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All of the following options are risk factors for chronic kidney disease (CKD) **EXCEPT**:

Select one:

- ☐ Family history of kidney disease ✖
- ☐ Certain ethnic groups ✖
- ☐ Comorbid autoimmune disorder ✖
- ☒ Patients with a low body mass ✔

Rose Wang (ID:113212) this answer is correct. Low body mass does not increase the risk of chronic kidney disease.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

To identify the risk factors associated with chronic kidney disease (CKD).

BACKGROUND:

Risk factors for the development of CKD include:

- Age ≥ 60 years
- Atherosclerosis: buildup of plaque within arteries
- Autoimmune diseases, e.g., lupus, rheumatoid arthritis, connective tissues disease, vasculitis
- Chronic urinary tract obstruction due to Benign Prostatic Hyperplasia (BPH), neurogenic bladder, or kidney stones
- Chronic viral infections, e.g., Hepatitis B and C, Human Immunodeficiency Virus (HIV)
- Diabetes mellitus
- Family history of CKD
- History of acute kidney injury
- Hypertension
- Member of one of the following ethnic groups: Asian, African or Caribbean, First Nations, Inuit or Metis, Hispanic, Pacific Islander, South Asian
- Multiple myeloma

- Obesity
- Polycystic kidney disease: inherited condition causing fluid, filled sacs called cysts develop in the kidney
- Pregnancy complication including edema, hypertension, and proteinuria
- Recurrent episodes of dehydration
- Recurrent episodes of pyelonephritis
- Reduced kidney mass, e.g., congenital single kidney (abnormal development of one of the kidneys), post-nephrectomy (surgical removal of the kidney), scarring from reflux nephropathy (kidney damage due to backflow of urine from the bladder to the kidney)
- Use of drugs known to be nephrotoxic (rapid worsening of kidney function due to toxic effects of drugs and/or chemicals)
- Drug-induced causes

RATIONALE:

Correct Answer:

- **Patients with a low body mass** - Low body mass does not increase the risk of chronic kidney disease.

Incorrect Answers:

- **Family history of kidney disease** - Certain causes of chronic kidney disease are hereditary, such as polycystic kidney disease.
- **Certain ethnic groups** - Ethnic groups that are at higher risk for diabetes mellitus and hypertension are also at higher risk for chronic kidney disease, such as members of Asian, African or Caribbean, First Nations, Inuit or Metis, Hispanic, Pacific Islander, or South Asian ethnicities.
- **Comorbid autoimmune disorder** - Autoimmune disorders can cause chronic kidney disease (e.g., lupus, anti-neutrophil cytoplasmic antibody-associated small vessel vasculitis).

TAKEAWAY/KEY POINTS:

There are multiple risk factors for the development of chronic kidney disease (CKD), including family history of CKD, certain ethnic groups, and comorbid autoimmune disorders.

REFERENCE:

[1] KDIGO 2017 clinical practice guideline update for the diagnosis, evaluation, prevention, and treatment of chronic kidney disease – mineral and bone disorder (CKD-MBD). *Kidney International Supplements*. 2017;7(1). doi: <http://dx.doi.org/10.1016/j.kisu.2017.04.001>.

[2] About chronic kidney disease. National Kidney Foundation. <https://www.kidney.org/atoz/content/about-chronic-kidney-disease>. Updated February 15, 2017.

The correct answer is: Patients with a low body mass

Question 3

ID: 54394

Correct

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All of the following are target parameters that should be monitored for patients who have diabetes and chronic kidney disease (CKD) **EXCEPT**:

Select one:

- ☐ Target systolic blood pressure less than 120 mmHg ✗
- ☐ Albumin-to-creatinine ratio (ACR) <3 mg/mmol ✗
- ☐ HbA1c <7% for diabetic patients ✗
- ☒ Serum sodium level between 135-145 mmol/L ✓

Rose Wang (ID:113212) this answer is correct. While this is the normal range for sodium, sodium isn't significantly affected by kidney disease and thus doesn't require close monitoring.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

To understand the monitoring parameters for patients with chronic kidney disease (CKD).

BACKGROUND:

Chronic kidney disease (CKD) is defined by the presence of kidney damage or a decrease in kidney function lasting for at least three months. The first sign of CKD is often a reduction in creatinine clearance and/or proteinuria. The staging of CKD is as follows:

CKD Staging

Kidney Function Stage	eGFR (ml/min/1.73m2)
G1 - normal or high	≥90
G2 - Mildly decreased	60 - 89
G3a - Mildly to moderately decreased	45 - 59
G3b - moderately to severely decreased	30 - 44
G4 - severely decreased	15 - 29
G5 - kidney failure	<15 or on dialysis

Albuminuria Stage	Albuminuria (mg/mmol)
A1	<3
A2	3 - 30
A3	>30

Other changes in bloodwork include:

- Decreased hemoglobin, hematocrit, and ferritin
- Decreased calcium
- Decreased bicarbonate (i.e., a shift towards metabolic acidosis)
- Increased phosphate
- Increased potassium

Symptoms often begin to appear at stage G3b. Symptoms initially are mild but can progress and become severe as kidney function continues to drop. Symptoms include:

- Confusion
- Lack of energy
- Pruritis
- Lack of appetite
- Edema
- Lack of urination
- Nausea (in severe CKD)

For patients with CKD, the following monitoring parameters should be followed:

- Albumin-to-creatinine ratio (ACR) <3 mg/mmol (monitored every 3-6 months)
- Systolic blood pressure (SBP) <120 mmHg (standardized clinic BP measurement) (KDIGO 2021) (monitored every 1-2 months with the patient monitoring daily)

RATIONALE:

Correct Answer:

- **Serum sodium level between 135-145 mmol/L** - While this is the normal range for sodium, sodium isn't significantly affected by kidney disease and thus doesn't require close monitoring.

Incorrect Answers:

- **Target systolic blood pressure less than 120 mmHg** - The target systolic blood pressure for diabetic and non-diabetic patients with chronic kidney disease (CKD) is <120 mmHg.
- **Albumin-to-creatinine ratio (ACR) <3 mg/mmol** - The target albumin-to-creatinine ratio (ACR) for patients with chronic kidney disease (CKD) is <3 mg/mmol.
- **HbA1c <7% for diabetic patients** - The target HbA1c for most diabetic patients with chronic kidney disease (CKD) is <7%.

TAKEAWAY/KEY POINTS:

Monitoring parameters for patients with chronic kidney disease (CKD) include an albumin-to-creatinine ratio (ACR) <3 mg/mmol (monitored every 3-6 months) and systolic blood pressure (SBP) <120 mmHg (standardized clinic BP measurement) (monitored every 1-2 months with the patient monitoring daily).

REFERENCE:

[1] KDIGO 2021 clinical practice guideline for the management of blood pressure in chronic kidney disease. *Supplement to kidney International*. 2021;99(35).

The correct answer is: Serum sodium level between 135-145 mmol/L

Question 4

ID: 54395

Correct

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All of the following options are possible causes of inadequate iron stores **EXCEPT**:

Select one:

- ☐ Taking an iron supplement with a calcium supplement ✗
- ☐ Taking iron supplementation with a comorbid malabsorption disorder ✗
- ☐ Adhering to a vegetarian diet ✗
- ☒ Taking an iron supplement with a vitamin C supplement ✓

Rose Wang (ID:113212) this answer is correct. When administered together, vitamin C increases the absorption of iron.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

To understand the role of iron supplementation in patients with anemia secondary to chronic kidney disease (CKD).

BACKGROUND:

Secondary causes of anemia include a lack of iron stores, serum folic acid concentration, serum vitamin B12 concentration, or lack of erythropoietin production (as caused by chronic kidney disease (CKD)). Oral iron supplementation comes in several forms:

Iron Supplements

Iron Salts (300 mg)	Elemental Iron Concentration
Ferrous gluconate	12% (33 mg)
Ferrous sulfate	20% (60 mg)
Ferrous fumarate	33% (99 mg)

Common side effects of oral iron salt supplementation include:

- Gastrointestinal upset
- Constipation
- Black/tarry stool

Iron from these iron salts is best absorbed if taken with vitamin C as it prevents the formation of insoluble iron complexes and increases reduction of less absorbable ferric to more absorbable ferrous state.

Other forms of iron include heme iron polypeptides, polysaccharide-iron complexes, and iron amino acid chelate (e.g., iron bisglycinate). These are more expensive forms of oral iron supplements but are associated with reduced gastrointestinal side effects.

Heme iron polypeptides are obtained from animal sources; therefore, they have the highest oral bioavailability. Polysaccharide-iron complexes have iron bound to starch which is absorbed slowly throughout the gastrointestinal tract. Iron amino acid chelate has iron bound to amino acids that have high oral bioavailability.

RATIONALE:**Correct Answer:**

- **Taking an iron supplement with a vitamin C supplement** - When administered together, vitamin C increases the absorption of iron.

Incorrect Answers:

- **Taking an iron supplement with a calcium supplement** - Calcium binds to iron and reduces its absorption, making the iron supplement ineffective. Administration should be separated by at least 2 hours.
- **Taking iron supplementation with a comorbid malabsorption disorder** - Iron supplementation will not be properly absorbed with certain malabsorption disorders, such as celiac disease.
- **Adhering to a vegetarian diet** - Meat provides iron that is more efficiently absorbed than iron found in vegetables (heme iron vs non-heme iron, respectively).

TAKEAWAY/KEY POINTS:

Iron supplements are commonly prescribed for patients with chronic kidney disease (CKD); therefore, it is important to know the different types of supplements available and how to best administer them.

REFERENCE:

[1] Iron fact sheet for health professionals. National Institutes of Health. <https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/#en20>. Updated December 7, 2019.

[2] Ierrie YC. Iron supplements: treating iron-deficiency anemia. Pharmacy Times. <https://www.pharmacytimes.com/publications/issue/2014/june2014/iron-supplements-treating-iron-deficiency-anemia>.

The correct answer is: Taking an iron supplement with a vitamin C supplement

Question 5

ID: 54397

Correct

Flag question

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A patient asks for advice regarding starting an oral iron supplement for the first time.

All of the following are correct recommendations **EXCEPT**:

Select one:

- ☐ a. Heme iron polypeptides were originally thought to be better tolerated than ferrous salts ✖
- ☒ b. Ferrous salts should always be taken with food to minimize stomach upset ✔
- ☐ c. Iron supplements may be taken with vitamin C ✖
- ☐ d. Ferrous fumarate is more likely to cause constipation than ferrous sulphate ✖

Rose Wang (ID:113212) this answer is correct. A patient trying iron supplements for the first time should try it on an empty stomach first as this improves iron bioavailability.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

Chronic kidney disease (CKD) can cause anemia, and it is, therefore, necessary to understand what affects iron stores in the body.

BACKGROUND:

Secondary causes of anemia include a lack of iron stores, serum folic acid concentration, serum vitamin B12 concentration, or lack of erythropoietin production (as caused by CKD). Iron supplementation comes in several forms:

Iron Supplements

Iron Salts (300 mg)	Elemental Iron Concentration
Ferrous gluconate	12% (33 mg)
Ferrous sulphate	20% (60 mg)
Ferrous fumarate	33% (99 mg)

Common side effects of iron salt supplementation include:

- Gastrointestinal upset
- Constipation
- Black/tarry stool

Iron from these iron salts is best absorbed if given along with vitamin C as it prevents the formation of insoluble iron complexes and increases reduction of less absorbable ferric to more absorbable ferrous state.

Other forms of iron include heme iron polypeptides, polysaccharide-iron complexes, and iron amino acid chelate (e.g. iron bisglycinate). These are more expensive forms of iron supplements but are associated with reduced gastrointestinal side effects.

Heme iron polypeptides - animal sourced iron, which therefore has a higher oral bioavailability

Polysaccharide-iron complexes - iron bound to starch which is absorbed slowly throughout the gastrointestinal tract

Iron amino acid chelate - iron bound to amino acid has high oral bioavailability

RATIONALE:

Correct Answer:

- **Ferrous salts should always be taken with food to minimize stomach upset** - A patient trying iron supplements for the first time should try it on an empty stomach first as this improves iron bioavailability.

Incorrect Answers:

- **Heme iron polypeptides were originally thought to be better tolerated than ferrous salts** - Heme iron polypeptide supplements are more expensive, and are not as well-tolerated as originally thought.
- **Iron supplements may be taken with vitamin C** - Some evidence suggests that vitamin C only has a modest benefit on iron absorption but it may be tried.
- **Ferrous fumarate is more likely to cause constipation than ferrous sulphate** - The higher the concentration of elemental iron in the iron salt, the higher the risk of side effects.

TAKEAWAY/KEY POINTS:

Iron supplements are commonly prescribed to individuals with CKD and it is therefore important to know the different types of supplements available and how to best administer these supplements.

REFERENCE:

[1] Iron fact sheet for health professionals. National Institutes of Health.

<https://ods.od.nih.gov/factsheets/Iron-HealthProfessional/#en20>. Updated December 7, 2019.

[2] Terrie YC. Iron supplements: treating iron-deficiency anemia. Pharmacy Times.

<https://www.pharmacytimes.com/publications/issue/2014/june2014/iron-supplements-treating-iron-deficiency-anemia>.

The correct answer is: Ferrous salts should always be taken with food to minimize stomach upset

Question 6

ID: 34399

Correct

Flag question

Send Feedback

Which of the following situations warrant intravenous iron supplementation?

Select one:

☒ Patient that is unresponsive to an erythropoietin-stimulating agent and on a maximum dose of oral iron therapy

Rose Wang (ID:113212) this answer is correct. Successful red blood cell formation requires erythropoietin and sufficient iron stores.

☐ Patient with stage 4 kidney disease that is responsive and tolerant to oral therapy ✗

☐ Pregnant woman who has an iron deficiency ✗

☐ Patient requiring oral iron supplementation T1D for therapeutic effectiveness ✗

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

Chronic kidney disease (CKD) can cause anemia, and it is therefore necessary to understand how to treat iron deficiency.

BACKGROUND:

Anemia is diagnosed as having a hemoglobin level less than 130 g/L (males) or less than 120 g/L (females). It can be caused by a lack of iron stores, lack of folate, and/or lack of vitamin B12. Iron level is tested in several ways:

Serum iron level

Serum ferritin level - ferritin stores iron and releases it when iron is needed; this test indicates iron store levels

Total iron-binding capacity (TIBC) - this measures the total amount of iron that can be stored

Transferrin saturation (TSAT) - This measures how much iron is bound in the blood

Serum ferritin level can be falsely elevated if the patient is in an inflammatory state.

Oral iron supplementation comes in several forms:

Iron Supplements

Iron Salts (300 mg)	Elemental Iron Concentration
Ferrous gluconate	12% (33 mg)
Ferrous sulphate	20% (60 mg)
Ferrous fumarate	33% (99 mg)

Other forms of iron include heme iron polypeptides, polysaccharide-iron complexes, and iron amino acid chelate (e.g. iron bisglycinate). These are more expensive forms of iron supplements but are associated with reduced gastrointestinal side effects.

Heme iron polypeptides - animal sourced iron, which therefore has a higher oral bioavailability

Polysaccharide-iron complexes - iron bound to starch which is absorbed slowly throughout the gastrointestinal tract

Iron amino acid chelate - iron bound to amino acid has high oral bioavailability

Parenteral supplementation is generally not first-line treatment in chronic kidney disease unless the patient is very low in iron stores (i.e. TSAT < 30% and ferritin < 500 mcg/L). If patients require erythropoietin-stimulating agents (ESA), they will also need sufficient iron stores to ensure therapeutic response to ESA as red blood cells cannot be formed without iron.

RATIONALE:

Correct Answer:

- Patient that is unresponsive to an erythropoietin-stimulating agent and on a maximum dose of oral iron therapy - Successful red blood cell formation requires erythropoietin and sufficient iron

stores.

Incorrect Answers:

- **Patient with stage 4 kidney disease that is responsive and tolerant to oral therapy** - Intravenous iron supplementation is not a first-line treatment option in this population.
- **Pregnant woman who has an iron deficiency** - Oral iron supplementation should be tried first before intravenous treatment.
- **Patient requiring oral iron supplementation T1D for therapeutic effectiveness** - Although this is likely inconvenient for the patient, there is a more correct response.

TAKEAWAY/KEY POINTS:

Oral iron supplementation is preferred compared to intravenous iron supplementation.

REFERENCE:

[1] KDIGO clinical practice guideline for anemia in chronic kidney disease. *KDIGO*. 2012;2(4). doi: 10.1038/kisup.2012.37.

[2] Saljoughian M. Parenteral irons: indications and comparison. *US Pharm*. 2010;35(11):HS-22-HS-24.

The correct answer is: Patient that is unresponsive to an erythropoietin-stimulating agent and on a maximum dose of oral iron therapy

Question 7

ID: S4407

Incorrect

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Which of the following parameters represent the earliest response to iron therapy?

Select one:

☐ a. Serum ferritin

Rose Wang (ID:113212) this answer is incorrect. There is a parameter that increases faster than this one in response to iron therapy.

☐ b. Hemoglobin

☒ c. Absolute reticulocyte count

☐ d. Total iron binding capacity (TIBC)

Incorrect

Marks for this submission: 0.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

Chronic kidney disease (CKD) can cause anemia, and it is therefore necessary to understand how to assess iron therapy efficiency.

BACKGROUND:

Anemia is diagnosed as having a hemoglobin level less than 130 g/L (males) or less than 120 g/L (females). It can be caused by a lack of iron stores, lack of folate, and/or lack of vitamin B12. Iron level is tested in several ways:

Serum iron level

Serum ferritin level - ferritin stores iron and releases it when iron is needed; this test indicates iron store levels

Total iron-binding capacity (TIBC) - this measures the total amount of iron that can be stored

Transferrin saturation (TSAT) - This measures how much iron is bound in the blood

Serum ferritin level can be falsely elevated if the patient is in an inflammatory state.

Oral iron supplementation comes in several forms:

Iron Supplements

Iron Salts (300 mg)	Elemental Iron Concentration
Ferrous gluconate	12% (33 mg)
Ferrous sulphate	20% (60 mg)
Ferrous fumarate	33% (99 mg)

Other forms of iron include heme iron polypeptides, polysaccharide-iron complexes, and iron amino acid chelate (e.g. iron bisglycinate). These are more expensive forms of iron supplements but are associated with reduced gastrointestinal side effects.

Heme iron polypeptides - animal sourced iron, which therefore has a higher oral bioavailability

Polysaccharide-iron complexes - iron bound to starch which is absorbed slowly throughout the gastrointestinal tract

Iron amino acid chelate - iron bound to amino acid has high oral bioavailability

Once oral iron treatment is initiated, the absolute reticulocyte count will begin to rise within 1 week. However, this marker fluctuates easily and so it is not used to evaluate the iron dose. An increase of hemoglobin increase of 10 g/L within one month indicates the treatment is effective. Treatment is then continued for at least 2-3 months in order to replenish serum iron stores.

RATIONALE:

Correct Answer:

- **Absolute reticulocyte count** - Reticulocytes response is evident within 1 week of iron therapy initiation.

Incorrect Answers:

- **Serum ferritin** - There is a parameter that increases faster than this one in response to iron therapy.
- **Hemoglobin** - There is a parameter that increases faster than this one in response to iron therapy.
- **Total iron binding capacity (TIBC)** - There is a parameter that increases faster than this one in response to iron therapy.

TAKEAWAY/KEY POINTS:

A rise in absolute reticulocyte count is the earliest indicator of iron therapy effectiveness, but hemoglobin measurement is used to actually evaluate iron treatment effectiveness.

REFERENCE:

[1] KDIGO clinical practice guideline for anemia in chronic kidney disease. *KDIGO*. 2012;2(4). doi: 10.1038/kisup.2012.37.

[2] Saljoughian M. Parenteral irons: indications and comparison. *US Pharm*. 2010;35(11):HS-22-HS-24.

[3] Short MW, Domagalski JE. Iron deficiency anemia: evaluation and management. *Am Fam Physician*. 2013; 87(2):98-104. <https://www.aafp.org/afp/2013/0115/p98.html>.

The correct answer is: Absolute reticulocyte count

Question 8

ID: 34408

Correct

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Which of the following statements best describes the relationship between chronic kidney disease (CKD) and smoking?

Select one:

- ☐ a. Smokers with CKD have a higher risk of developing lung cancer ✗
- ☒ b. Smoking can increase the speed of CKD progression ✓
- ☐ c. Smoking cessation medications are contraindicated in CKD ✗
- ☐ d. There is no relationship between CKD and smoking ✗

Rose Wang (ID:113212) this answer is correct. Smoking is associated with faster progression of CKD and can cause kidney failure.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

To understand the definition of chronic kidney disease and risk factors for disease progression.

BACKGROUND:

Chronic kidney disease (CKD) is defined by the presence of kidney damage or a decrease in kidney function lasting for at least three months. The first sign of CKD is often a reduction in creatinine clearance and/or proteinuria. The staging of CKD is as follows:

CKD Staging

Kidney Function Stage	eGFR (ml/min/1.73m ²)
G1 - normal or high	≥90
G2 - Mildly decreased	60 - 89
G3a - Mildly to moderately decreased	45 - 59
G3b - moderately to severely decreased	30 - 44
G4 - severely decreased	15 - 29
G5 - kidney failure	<15 or on dialysis

Albuminuria Stage	Albuminuria (mg/mmol)
A1	<3
A2	3 - 30
A3	>30

Other changes to bloodwork include:

Other changes in bloodwork include:

- Decreased hemoglobin, hematocrit, and ferritin
- Decreased calcium
- Decreased bicarbonate (i.e. a shift towards metabolic acidosis)
- Increased phosphate
- Increased potassium

Symptoms often begin to appear at stage G3b. Symptoms initially are mild but can progress and become severe as kidney function continues to drop. Symptoms include:

- Confusion
- Lack of energy
- Pruritis
- Lack of appetite
- Edema
- Lack of urination
- Nausea (in severe CKD)

Causes of CKD

Primary Causes	Secondary Causes
Glomerulonephritis	Hypertension
Polycystic kidney disease	Diabetes
Alport Syndrome	Acute kidney injury
Abnormal kidney development	Lupus
	Renal obstruction (e.g. kidney stones, benign prostate hypertrophy, tumour)
	Recurring urinary tract infections
	Certain medications (e.g. lithium)

Smoking has been associated with renal failure and is likely to worsen CKD progression as it affects oxygen levels in the blood, increases blood pressure, and causes inflammatory responses in the body. It is important to encourage CKD patients to quit smoking for their overall health and to slow the progression of the disease.

RATIONALE:

Correct Answer:

- **Smoking can increase the speed of CKD progression** - Smoking is associated with faster progression of CKD and can cause kidney failure.

Incorrect Answers:

- **Smokers with CKD have a higher risk of developing lung cancer** - Smokers are at increased risk of developing lung cancer independent of kidney function.
- **Smoking cessation medications are contraindicated in CKD** - Smoking cessation therapy can be used in CKD patients, although some drugs may require renal dose adjusting.
- **There is no relationship between CKD and smoking** - There is a relationship between CKD and smoking

TAKEAWAY/KEY POINTS:

Promoting smoking cessation is important when speaking with anyone who smokes cigarettes, but it should be stressed that patients with CKD who continue smoking are increasing their risk of worsening their CKD progression and renal failure.

REFERENCE:

[1] KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. *Kidney International Supplements*. 2013;3(1). doi:10.1038/kisup.2012.74.

[2] About chronic kidney disease. National Kidney Foundation. <https://www.kidney.org/atoz/content/about-chronic-kidney-disease>. Updated February 15, 2017.

The correct answer is: Smoking can increase the speed of CKD progression

Question 9

ID: 34409

JE is a 62-year-old male with stage 4 chronic kidney disease. His medications include:

- **Terazosin 5 mg once daily**

Correct

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- Amlodipine 10 mg once daily
- Sitagliptin 25 mg once daily

JE's most recent blood work shows:

- Hemoglobin is 115 g/L (normal range ≥ 130 g/L)
- Ferritin of 20 mcg/L (normal range 24-336 mcg/L)
- Transferrin saturation of 18% (normal range 20-50%)

JE says he has been feeling more tired than usual the past month but denies having any other symptoms of anemia.

What would be the best recommendation for JE?

Select one:

- ☐ JE requires an erythropoietin stimulating agent ✖
- ☐ JE requires a single IV iron infusion ✖
- ☐ JE requires folic acid ✖
- ☒ JE requires ferrous fumarate once daily ✔

Rose Wang (ID:113212) this answer is correct. Ferrous fumarate is the option with the best potential benefit and least risk for JE.

Correct

Marks for this submission: 1.0/1.0.

TOPIC: Chronic kidney disease

LEARNING OBJECTIVE:

Chronic kidney disease (CKD) can cause anemia, and it is therefore necessary to understand how to treat iron deficiency.

BACKGROUND:

Anemia is diagnosed as having a hemoglobin level less than 130 g/L (males) or less than 120 g/L (females). It can be caused by a lack of iron stores, lack of folate, and/or lack of vitamin B12. Iron level is tested in several ways:

- Serum iron level
- Serum ferritin level - ferritin stores iron and releases it when iron is needed; this test indicates iron store levels
- Total iron-binding capacity (TIBC) - this measures the total amount of iron that can be stored
- Transferrin saturation (TSAT) - This measures how much iron is bound in the blood

Serum ferritin level can be falsely elevated if the patient is in an inflammatory state.

Oral iron supplementation comes in several forms:

Iron Supplements

Iron Salts (300 mg)	Elemental Iron Concentration
Ferrous gluconate	12% (33 mg)
Ferrous sulphate	20% (60 mg)
Ferrous fumarate	33% (99 mg)

Other forms of iron include heme iron polypeptides, polysaccharide-iron complexes, and iron amino acid chelate (e.g. iron bisglycinate). These are more expensive forms of iron supplements but are associated with reduced gastrointestinal side effects.

- Heme iron polypeptides - animal sourced iron, which therefore has a higher oral bioavailability
- Polysaccharide-iron complexes - iron bound to starch which is absorbed slowly throughout the gastrointestinal tract
- Iron amino acid chelate - iron bound to amino acid has a high oral bioavailability

Epoetin stimulating agents (ESA) are associated with serious adverse effects and are typically not used until iron supplementation has been tried first. Parenteral supplementation is generally not the first-line treatment in chronic kidney disease unless the patient is unable to tolerate oral iron or has malabsorption. If a patient is stable and is not on oral supplementation, another appropriate choice is to try oral iron for 1 to 3 months; if iron stores and hemoglobin levels remain unchanged, then parenteral supplementation is required.

RATIONALE:

Correct Answer:

- JE requires ferrous fumarate once daily - Ferrous fumarate is the option with the best potential benefit and least risk for JE.

Incorrect Answers:

- **JE requires an erythropoietin stimulating agent** - JE is iron-deficient and would benefit from a trial of oral iron first.
- **JE requires a single IV iron infusion** - JE would benefit from a trial of oral iron first.
- **JE requires folic acid** - This is not the best option for JE at this time.

TAKEAWAY/KEY POINTS:

Oral iron supplementation is preferred compared to intravenous iron supplementation. Ferrous fumarate in this instance has a higher % of elemental iron and would improve iron stores in a shorter time frame.

REFERENCE:

[1] KDIGO clinical practice guideline for anemia in chronic kidney disease. *KDIGO*. 2012;2(4). doi: 10.1038/kisup.2012.37.

[2] Saljoughian M. Parenteral irons: indications and comparison. *US Pharm*. 2010;35(11):HS-22-HS-24.

[3] Medical Council of Canada. Clinical laboratory tests-Adult normal values. <https://mcc.ca/objectives/normal-values/?cn-reloaded=1>.

The correct answer is: JE requires ferrous fumarate once daily

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